Command and Control Assurance

Group 4

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Assumptions

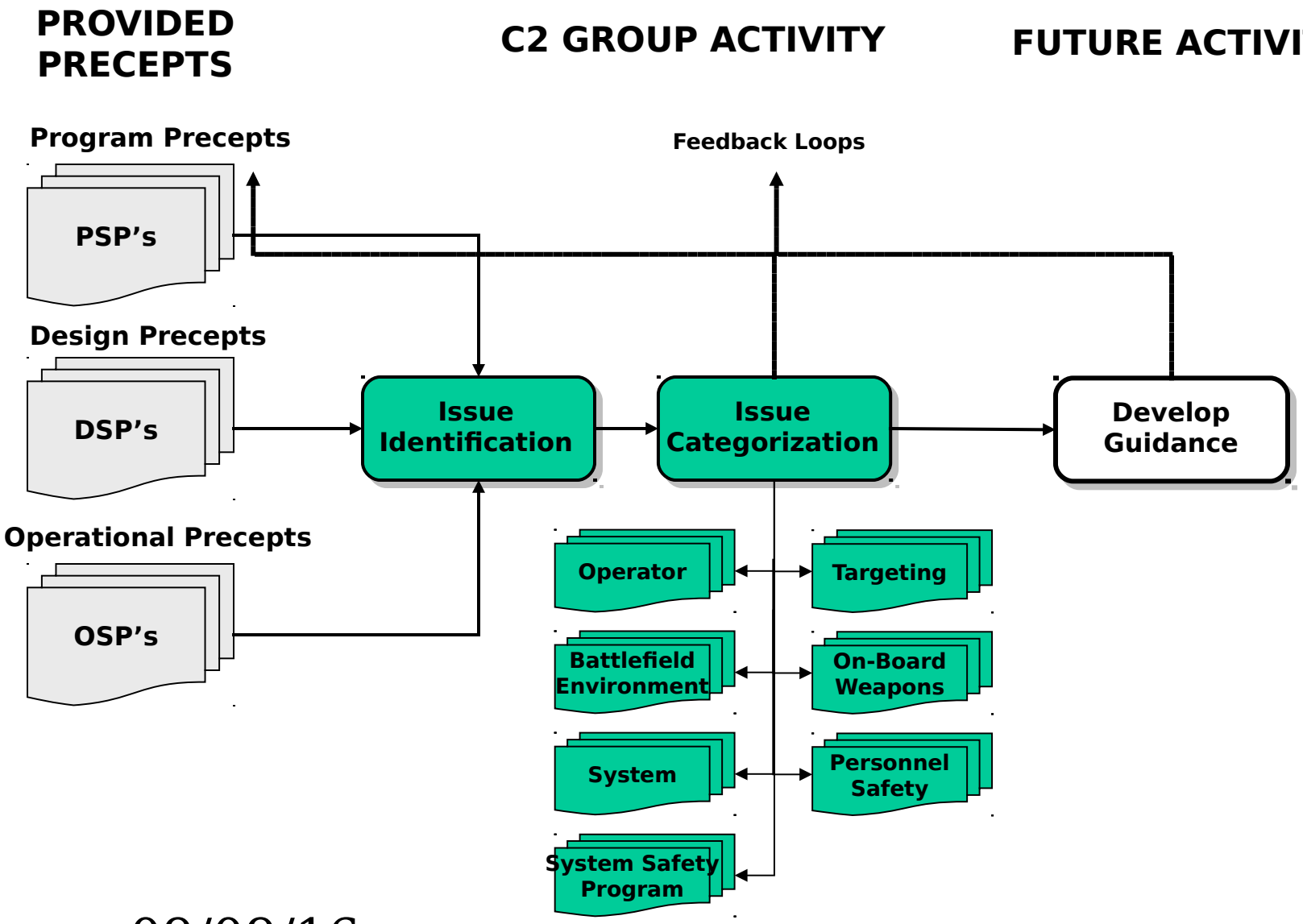
- Recommendations based upon Precept/TLM versions 4/3 (pre workshop)
- Communications part of discussions
- Not design solutions but potential generic issues and precepts
- CONOPS will be a primary input to additions/modifications to these precepts

Definition Issues

- Precept – inviolate or not?.
- Positive control
  - dependent upon type and usage of system
- Level of Autonomy
  - define and tie back to positive control
- Combat power / mission performance
- Purple Suit – Joint/Interagency/Coalition considerations
- Fusion/correlation/association –
- Positive target – ID, Location,?? What constitutes a valid target

Definitions need to be refined for Common Joint Language

COMMAND AND CONTROL WORKING GROUP



Review Areas

- 1.0 Operator
- 2.0 Battlefield Environment
- 3.0 System Design – (Asset)
- 4.0 Targeting
- 5.0 On Board Weapons
- 6.0 Personnel safety (other than operator)

Overarching Issues

- Group name – C3, C4, C5???
- Mishaps 1&3 hazards of a new TLM 1
  - TLM 3 then deleted
- There are 2 DSP-6 items
  - we listed as 6a and 6b
- DSP-14 and DSP-15
  - Should these precepts be split out in terms of the items listed?

1.0 Operator Issues

- 1.1 Operator Procedures and Training
- 1.2 Operator Certification Criteria
- 1.3 Operator Situational Awareness/understanding
  - 1.3.1 Good Displays, Bad Data Input
  - 1.3.2 Bad Displays, Good Data Input
- 1.4 Human/Machine Interface
- 1.5 Operator loading
  - 1.5.1 Man in the loop requirement

1.0 Operator Remarks

- Recommend new precept for minimizing numbers of procedures. Be aware of automation irony
- Span of Control on number of vehicles/systems the operator can control
  - Recommend new precept here – perhaps review data like FAA limits on Controllers
- Requirements for operation within normal transportation systems (NAS, DOT, International Standards, and Insurability)
- Standardization of vehicle control (operator) systems in terms of operations and symbology
- If target is human, you require 1v1 control. (Legal review)
  - Military only

2.0 Battlefield Environment Issues

- 2.1 Define the Predicted or Intended Battle-Space (CONOPS)
- 2.2 Network Integration Criteria
- 2.3 Define the Intended RF Spectrum (intended use)
- 2.4 Spectrum Saturation
  - 2.4.1 Congestion Resolution Criteria
  - 2.4.2 De-confliction Resolution Criteria
- 2.5 Clearance to Operate in Theater
- 2.6 Collision Avoidance Criteria
  - 2.6.1 Congestion Resolution Criteria
  - 2.6.2 De-confliction Resolution Criteria
- 2.7 Manned Systems and Unmanned Systems in the same Battlefield Environment
- 2.8 Purple-Suit Standardization
  - 2.8.1 Data Links
  - 2.8.2 Networks
  - 2.8.3 Internet
  - 2.8.4 CONOPS
  - 2.8.5 Definitions
  - 2.8.6 Integrated Procedural Processes
  - 2.8.7Common message protocols
  - 2.8.8 Data models
  - 2.8.9 Integrated agency training
- Mission planning/coordination/execution
- ROE Clearance of fires

2.0 Battlefield Environment Remarks

- Ensure spectrum availability/reservation early in the program
  - Consider Programmatic precept for spectrum review early in program
  - C4I Support Plan – required for Milestone Process
- Control links for vehicles, uplinks/downlinks for sensors & data in a designated Battlespace, Local/long range
- Common/Joint/Interagency/Coalition Message Protocols
  - Symbology, operations, data
- Ways to keep data/links secure and prevent exploitation of systems (information assurance)
  - Crypto
  - Sterilization
  - …

2.0 Battlefield Environment Issues (continued)

- Mixed Mode Operation - System needs to provide positive separation between tactical and training data
  - Mode requirements, tactical vice training operational separation
- Chain of Command, ROE Surety, and Commanders Intent
  - Command level overrides
  - Change allowance/change propagation
  - Full auto settings, semi auto
- Clearance of fires
  - Local Control or Global Control Issue
  - Definition of level of clearance required
  - Situational Awareness, including friendly forces and non-combatants.
  - Prevention of collateral damage

3.0 System Design- (Asset) Issues

- 3.1 Definition of “Positive Control”
  - 3.1.1 Program-Specific Definition
  - 3.1.2 Purple-Suite Definition
  - 3.1.3 Levels of Positive Control Definitions
- 3.2 Definition of a Predictable Course of Action if “Loss of Control” is Experienced
- 3.3 Method to Reduce Likelihood of Hostile Take-over of the System Asset
- 3.4 Method to Reduce Likelihood of Unintended Take-over of System Asset by Friendly Forces (including multiple sources)
- 3.5 Positive Identification of the System Asset by the Control Authority
- 3.6 Graceful Degradation of the System Asset
  - 3.6.1 Health and Status Monitoring of the System
  - 3.6.2 Determination to Sterilize to a Defined Safe State
- 3.7 Data/Information Assurance Criteria
- 3.8 Communication Assurance Criteria
- 3.9 (UAV) Integration into Air Tasking Orders
- 3.10 Continuous Monitoring of System State
  - 3.10.1 Initialization
  - 3.10.2 Operations
  - 3.10.3 Operational Recovery
  - 3.10.4 Emergency Recovery
- 3.11 Certification of Intended (Qualified) Operator
- 3.12 Man/Machine Interface
- 3.13 States and Mode
- ManagementFailure/fault management

3.0 System Design- (Asset) Remarks

- Positive Control
  - Include DSP Precept for verifying positive control of vehicle. Mitigation through local control at the asset.
  - Dependent upon domain of operations
  - Levels of autonomy need to be associated here
- Robustness for intermittent comms
  - Look at re-initialization of communication to verify state and configuration
  - Design guidance for a crosscheck of ID by both control system and vehicle (beyond 1 vehicle)
- Road/Terrain Analog to Air/Sea Worthiness
  - Acceptance Criteria defined by levels of autonomy
- Use monitoring to ensure non-propagation of hazards throughout vehicle/system
  - Prevent escalation to mishaps, propagation to more serious events

4.0 Targeting Issues

4.1 Definition of Positive Target

- 4.1.1 Target Identification
- 4.1.2 Target location/precision
- 4.1.3 Correlation/fusion/association

4.2 Command and Control Integration with IFF

4.3 Engage / Break-Engage Definitions

4.4 Battlefield Damage Assessments

4.5 Establishment of NO-POINT / NO-FIRE Criteria

Targeting items identified (with no remarks), but not resolve

5.0 Onboard Weapon Issues

- 5.1 Methods to Prevent Inadvertent or Un-commanded:
  - 5.1.1 Weapons Initialization
  - 5.1.2 Weapons Arming
  - 5.1.3 Weapons Targeting
  - 5.1.4 Weapons Shutdown
- 5.2 Threat evaluation and weapon selection
- 5.3 Weapon health, status and State monitoring

5.0 Onboard Weapon Remarks

- Anti tamper to weapon and vehicle
  - Use of embedded explosives to destroy hardware (potential land mine issue)
- Design of weapons that are not usable off vehicle
- Additional assurance of firing/arming commands required

6.0 Personnel Safety (other than operator) Issues

- 6.1 Decontamination of System Upon Recovery
- 6.2 Exposure to Unintended …….
  - 6.2.1
  - 6.2.2
  - 6.2.3

6.0 Personnel Safety (other than operator) Remarks

- Exposure to Toxic/Biohazard
  - Safety/Survivability/Vulnerability Issue (Difference in philosophy)
  - Vehicle needs to indicate if it was “exposed” and is it a carrier
  - How and where detection upon retrieval

Post Conference Work

- Define and clarify C2 definitions
- Review C3 taxonomy database for additional items and software tie in (data FOUO)
- Dynamic Interaction
  - Development of Guidelines
  - Collaboration